# Exploring Light Qualities in Sustainable Homes

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# Exploring Light Qualities in Sustainable Homes

Part of the PhD project: "A Method for Holistic Evaluation of Sustainable Buildings"

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*"I only wish that the first really worthwhile discovery of science would be that it recognized that the unmeasurable is what they're really fighting to understand, and that the measurable is only the servant of the unmeasurable; that everything that man makes must be fundamentally unmeasurable."*

– Louis Kahn

## Project description of PhD project 'A Method for Holistic Evaluation of Sustainable Buildings'

Interest in quantitative assessment of building performance has increased through the last decades in line with the technical and practical development of sustainable buildings. Now, contours of a more holistic approach to sustainable buildings begin to emerge and the increasingly holistic approach calls for new ways to assess and evaluate our buildings, not solely based on quantitative means but particularly based on qualitative means. The question emerges of *how we can determine and assess both quantitative and qualitative qualitative aspects of sustainable buildings without deducting the value of either of them.*

Research set up The research project consists in measuring, registering, analyzing and comparing seven houses and occupants – through *both* quantitative *and* qualitative studies. The quantitative performance is mapped though measurements on the technical performance in relation to energy and indoor climatic conditions. Qualitative performance is mapped through measurements on occupants' registered and verbalized experiences and through questionnaires, blogs and field research.

Research hypothesis Quantitative measurements on sustainable homes can help demonstrate low energy consumption and energy production by passive and renewable sources, healthy indoor climate and interaction with the surrounding environment.

Research hypothesis Qualitative measurements on sustainable homes can help demonstrate that its occupants experience benefits of a healthier indoor climate and effects on the surrounding environment and to discover increasing awareness of their energy behavior.

Research hypothesis Measuring qualitative and quantitative aspects of sustainable homes and their occupants makes it possible to identify what parameters are central to develop sustainable buildings of the future and design a method for holistic evaluation of these houses.

*How can we measure our buildings by their ability to improve our lives?*

Research design and methodology The project focus on inter-disciplinary issues related to developing sustainable buildings of the future. The research design is based on multi-disciplinary mixed methods sciences stretching from phenomenology and social science theory to measurements relying on a natural scientific approach. The various scientific approaches treat the same project problem but with different theories and methods thus illuminating the issues from different perspectives. The strategy is based on a Mixed Methods Research approach (Creswell 2006) that equally considers quantitative and qualitative aspects and data. Case Study Research (Yin 2009) methodology handles each house as an individual case in an embedded-multiple case setup. After data collection cross-comparison through comparative studies will provide for indentifying structures, sub-structures and miss-structures in the data extent. The structures are intended to indicate what parameters it is suitable to design the evaluation method on.

*How can we determine light qualities in sustainable homes?*

Light is a complex matter embracing both technical, functional, and aesthetic aspects if used and integrated intelligently in the design of our future sustainable buildings. We know much of how we can measure, monitor and registre the technical and functional aspects of light in buildings, but when it comes to aesthetic and qualitative aspects the recipe for registration is not as obvious or as developed.

The PhD project explores (among others) the hypothesis:
*We expect that the occupants experience that daylight and fresh air is a quality in the house.*

In order to explore this we use a Mixed Methods approach compiling data through the use of methods from various disciplines: Questionnaires for the occupants, Blog posts written by occupants, Field research, Photographs, TimeLapse and Simulation.

For exploration of light qualities and clarification of specifically what aspects to explore, a literature study in quality aspects of buildings and sustainable buildings has helped define four categories within light:

**Light anatomy**
*How is the design of the house optimized with regards to utilization of light?*

**Light space**
*How is the experience of respectively daylight and electrical light in the house and what spaces does it create?*

**Filtration of light**
*Are there light filtration light/shadow effects adding to the experiential qualities of the house – and how is this cultivated?*

**Movement of light**
*Does the movement of light in the house add to the quality of the inside and outside spaces?*

*Light anatomy*

*Light space*

*Filtration of light*

*Movement of light*